CLAIMS

What is claimed is:

1. An illumination system using filament lamps comprising:

a filament lamp;

a reflector having a first and second focal points;

said filament lamp disposed proximate to said first focal point of said reflector to emit rays of electromagnetic radiation that reflect from said reflector and converge substantially at said second focal point;

wherein a portion of the electromagnetic radiation emitted by said filament lamp impinges directly on said reflector and a portion of the electromagnetic radiation does not impinge directly on said reflector and wherein said system further comprises an additional reflector constructed and arranged to reflect at least part of the portion of the electromagnetic radiation that does not impinge directly on said reflector toward said reflector through the first focal point of said reflector.

2. The illumination system of claim 1, wherein said additional reflector comprises a spherical retro-reflector disposed on a side of said filament lamp opposite said reflector to reflect electromagnetic radiation emitted from said filament lamp in a direction away from said reflector toward said reflector through the first focal point of said reflector.

3. The illumination system of claim 1, wherein said additional reflector comprises a paraboloid retro-reflector and a flat reflector;

said paraboloid retro-reflector being disposed on a side of said filament lamp opposite said reflector to reflect electromagnetic radiation emitted from said filament lamp in a direction away from said reflector toward said flat reflector such that said electromagnetic radiation may be reflected by said flat reflector toward said paraboloid retro-reflector and through the first focal point of said reflector.

4. The illumination system of claim 1, wherein said filament lamp comprises a tungsten filament lamp.

5. The illumination system of claim 1, wherein said reflector has a coating that reflects substantially only a pre-specified portion of the electromagnetic radiation spectrum.

6. The illumination system of claim 5, wherein said pre-specified portion is selected from the group consisting of:

visible light radiation,

ultraviolet radiation,

infrared radiation,

a pre-specified band of wavelengths of radiation, and

a specific color of radiation.

7. The illumination system of claim 1, comprising further:

an output light pipe having an input surface and an output surface;

said input surface being located proximate to said second focal point to collect substantially all of said radiation; and

wherein said output surface transmits substantially all of said radiation.

8. The illumination system of claim 7, wherein said output light pipe is comprised of a material selected from the group consisting of quartz, glass, plastic, or acrylic.

9. The illumination system of claim 7, wherein said output light pipe is selected from the group consisting of:

a homogenizer,

a tapered light pipe, and

a straight light pipe.

10. The illumination system of claim 7, wherein said output light pipe comprises a cross-section, said cross-section being selected from the group consisting of:

a rectangle,

a circle,

a triangle,

a trapezoid,

a rhombus,

a pentagon,

a hexagon, and

an octagon.

11. The illumination system of claim 7, comprising further a fiber optic, the fiber optic being substantially illuminated by radiation transmitted at said output surface of said output light pipe, the fiber optic releasing the collected and condensed radiation to provide for illumination at a desired location.

12. The illumination system of claim 7, comprising further:

a condenser lens disposed substantially proximate to said output surface of said output light pipe;

an image projection system disposed substantially proximate to an output side of said condenser lens;

an image being illuminated by the radiation transmitted at said output surface of said output light pipe, the projection system releasing the collected and condensed radiation to display the image.

13. The illumination system of claim 1, wherein said reflector comprises a first reflector having a first optical axis and a second reflector having a second optical axis;

said second reflector being placed substantially symmetrically to said first reflector such that said first and second optical axes are substantially collinear; and

wherein said first focal point is a focal point of said first reflector and said second focal point is a focal point of said second reflector.

14. The illumination system of claim 13, wherein said first and second reflectors comprise at least a portion of a substantially ellipsoid surface of revolution.

15. The illumination system of claim 13, wherein said first and second reflectors comprise at least a portion of a substantially toric surface of revolution.

16. The illumination system of claim 13, wherein said first and second reflectors comprise at least a portion of a substantially spheroid surface of revolution.

17. The illumination system of claim 13, wherein said first and second reflectors comprise at least a portion of a substantially paraboloid surface of revolution.

18. The illumination system of claim 13, wherein:

said first reflector comprises at least a portion of a substantially ellipsoid surface of revolution; and

said second reflector comprises at least a portion of a substantially hyperboloid surface of revolution.

19. The illumination system of claim 13, wherein:

said first reflector comprises at least a portion of a substantially hyperboloid surface of revolution; and

said second reflector comprises at least a portion of a substantially ellipsoid surface of revolution.

20. The illumination system of claim 1, comprising further a waveguide disposed substantially proximate to said output surface, said waveguide selected from the group consisting of:

a single core optic fiber,

a fiber bundle,

a fused fiber bundle,

a polygonal rod, and

a hollow reflective light pipe.

21. The illumination system of claim 20, wherein said waveguide is selected from the group consisting of circular waveguides, polygonal waveguides, tapered waveguides and combinations thereof.

22. The illumination system of claim 20, wherein said waveguide is comprised of a material selected from the group consisting of quartz, glass, plastic, or acrylic.

23. The illumination system of claim 1, comprising further a filter placed substantially in a path of said rays of electromagnetic radiation.

24. The illumination system of claim 23, wherein said filter has a coating that reflects substantially only a pre-specified portion of the electromagnetic radiation spectrum.

25. The illumination system of claim 24, wherein said pre-specified portion is selected from the group consisting of:

visible light radiation,

ultraviolet radiation,

infrared radiation,

a pre-specified band of wavelengths of radiation, and

a specific color of radiation.

26. The illumination system of claim 23, wherein said filter has a coating that transmits substantially only a pre-specified portion of the electromagnetic radiation spectrum.

27. The illumination system of claim 24, wherein said pre-specified portion is selected from the group consisting of:

visible light radiation,

ultraviolet radiation,

infrared radiation,

a pre-specified band of wavelengths of radiation, and

a specific color of radiation.

28. A method of illumination comprising the steps of:

positioning a filament lamp at a first focal point of a reflector;

producing rays of radiation by said filament lamp;

reflecting a portion of said rays of radiation by said reflector toward a second focal point;

converging said rays of radiation at said second focal point;

reflecting at least part of a portion of the rays of radiation that do not impinge directly on said reflector toward said reflector through the first focal point of said reflector;

positioning a output light pipe having an input surface and an output surface so said input surface is substantially proximate to said second focal point;

collecting said rays of radiation at said input surface;

passing said rays of radiation through said output light pipe; and

outputting rays of radiation from said output surface of said output light pipe.

29. The method of illumination of claim 28, wherein said reflector comprises first and second reflectors;

wherein said first focal point is a focal point of said first reflector; and

said second focal point is a focal point of said second reflector.

30. The method of illumination of claim 29, wherein said first and second reflectors comprise at least a portion of a substantially paraboloid surface of revolution.

31. The method of illumination of claim 29, wherein said first and second reflectors comprise at least a portion of a substantially ellipsoid surface of revolution.

32. The method of illumination of claim 29, wherein:

said first reflector comprises at least a portion of a substantially ellipsoid surface of revolution; and

said second reflector comprises at least a portion of a substantially hyperboloid surface of revolution.

33. The method of illumination of claim 29, wherein:

said first reflector comprises at least a portion of a substantially hyperboloid surface of revolution; and

said second reflector comprises at least a portion of a substantially ellipsoid surface of revolution.